

EXECUTIVE SUMMARY

State Water Resources Control Board (SWRCB) staff have been conducting a comprehensive evaluation of the effectiveness of underground storage tank (UST) and piping systems, and associated leak detection equipment. The evaluation includes: a field-based research project to determine the frequency and source of releases from single and double-walled UST systems, a field evaluation of automatic tank gauges and automatic line leak detectors, a survey of statistical inventory reconciliation service providers, and a field evaluation of leak detection sensors. This report contains the findings of the field evaluation of leak detection sensors, which are the primary form of leak detection in double-walled UST systems. California's UST population currently consists of roughly 75% double-walled systems, making sensor performance a key element in the detection of leaks from UST systems statewide. The importance of sensors will only increase as older single-walled systems are phased out of service and replaced by double-walled systems.

Leak detection sensors are typically located in tank interstitial spaces, piping sumps, under-dispenser containment, and monitoring wells within excavation liners. They may also be located in groundwater monitoring wells or soil-vapor monitoring wells surrounding the tank system, although no such facilities were included in this field evaluation. California regulations require that all leak detection equipment be functionally tested and certified by an authorized service technician on an annual basis. This report was based largely on data collected from 789 sensors at 124 UST facilities during routine annual testing and certification. Also discussed in this report are 71 responses to an on-line survey on sensor performance, completed by service technicians and inspectors. It is important to note that federal regulations and other state UST programs do not require annual certification of monitoring equipment. One may assume that the sensor performance problems identified in this field evaluation would be significantly more common if California did not require the annual certification of monitoring equipment.

Federal and California regulations require that leak detection equipment be evaluated by an independent third-party testing organization in accordance with recognized protocols. However, these evaluation protocols are designed only to test sensor functionality in a laboratory setting. The objective of this field evaluation was to assess sensor functionality under field conditions. We also set out to determine the adequacy of annual certification testing procedures, and to determine whether sensors in the field perform in a manner consistent with the specifications outlined in their third-party evaluations.

The data collected in this field evaluation demonstrate that sensors can be a reliable form of leak detection only when properly installed, programmed, maintained, and operated. Most problems observed in this field evaluation are due to improper installation and programming of sensors, poor or infrequent maintenance at UST facilities, ignoring alarms, and tampering with monitoring equipment. Poor design, construction, and maintenance of secondary containment systems were also common. Additionally, sensor design and materials played a role in some of the failures observed.

Findings - Effective performance of sensors is also dependent upon the performance of the secondary containment in which they are installed. Therefore, this report's findings are presented in two categories: sensor performance and secondary containment performance.

Sensor Performance - Approximately 12% of sensors had one or more problems at the time of testing. The most common problems observed were sensors raised from the low point of the secondary containment, sensors failing to alarm when tested, and sensors failing to shut down the turbine pump in the event of an alarm (when programmed to do so).

Secondary Containment System Performance - Problems with the performance of secondary containment were more common than problems with sensors. Secondary containment must be kept clean and dry in order for sensors to perform properly; however, water was found in over 10% of secondary containment systems. Liquid product was present in an additional 3.5% of systems. Overall, 31% of the facilities visited in this field evaluation had water or product in one or more areas of the secondary containment system.

Recommendations - Based on the findings of this field evaluation, we propose the following recommendations to improve sensor performance and the effectiveness of leak detection programs based on the use of sensors:

1. Periodic inspection and functional testing of sensors and secondary containment are essential to reliable performance. California currently requires annual certification of monitoring equipment, and triennial integrity testing of all secondary containment. The United States Environmental Protection Agency (U.S. EPA) and states not currently requiring annual certification of monitoring equipment and periodic testing of secondary containment should consider implementing such requirements.
2. Sensor manufacturers should continue to refine sensor design and field testing procedures. Sensors must be designed to reliably operate under the conditions found within the secondary containment of an UST. Field testing procedures should involve functional testing of the sensor, and should accurately determine the ability of the sensor to detect a release.
3. Standard third-party evaluation protocols for sensors should be revised to better reflect operating conditions found in the field. SWRCB UST program staff has been active in the efforts of the National Workgroup on Leak Detection Evaluations to improve the evaluation and review process.
4. Regulatory agencies should call for more thorough training of personnel who install, service, and operate UST leak detection systems. A recent California statute requires training for these individuals, and the SWRCB is currently developing regulations to implement a training standard statewide.
5. Regulatory agencies must have authority to take enforcement action against UST owners and operators who tamper with leak detection equipment. The SWRCB has proposed legislation that would grant regulators administrative enforcement authority, and allow them to "red-tag" facilities that are significantly out of compliance.